REMARKS

Claims 9 and 11-17 are currently pending in the present application, with claims 1-8 standing withdrawn pursuant to the Election/Restriction Requirement of October 22, 2004.

Double-Patenting Rejection: Claims 9 and 13-17 stand rejected under the non-statutory double-patenting doctrine in view of claims 6-17 of U.S. Patent No. 6,952,138. The Applicants are filing herewith a Terminal Disclaimer to overcome this rejection. Withdrawal of the double-patenting rejection is respectfully requested.

Section 103(a) Rejection: Claims 9 and 11-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 5,445,325 to White ("White"). The Applicants respectfully traverse this rejection on the grounds that this reference fails to teach or suggest all of the features recited in claims 9 and 11-17 for which it is cited.

As noted in the Applicants' October 28, 2005 Reply, previously known spraying systems relying on de Laval-type nozzles for gas acceleration had their particle-injection points located so that they did not disturb the carefully defined geometry of the Laval nozzle (*i.e.*, said geometry providing the desired convergent-divergent flow without flow separations and compression shocks). *See, e.g.*, Specification ¶ [0003]; Van Steenkiste Fig. 2 (tube carrying the particles to their release point located well upstream of the nozzle, where it cannot interfere with the flow converging into the nozzle neck). Browning Fig. 2a (outlet in wall in divergent section); Ek Fig. 1 (outlet in wall at nozzle neck). The

prior art thus consistently taught that particles should be injected in a manner which avoids disturbing the Laval nozzle geometry.

Contrary to the prior art, the Applicants discovered that an axial particle injection tube *could* be provided in the divergent section of the nozzle, thus gaining numerous advantages, while still maintaining the desired Laval flow, if the nozzle components were appropriately designed (*i.e.*, by shaping the inner surface of the outer portion of the nozzle, and the outer surface of the particle tube to cooperate with one another to provide the desired flow). This discovery allows the present cold spray system to operate substantially more efficiently, as well as being considerably less costly to manufacture and maintain as compared to the prior art.[1] Claim 9 accordingly recites, *inter alia*, a cold gas spraying system in which "the powder tube *ends in a divergent section* of the Laval nozzle and is aligned axially and centrically with the outer nozzle body," and "the Laval Nozzle is formed by an inner shape of the outer nozzle body together with an outer shape of the powder tube arranged coaxially in the outer nozzle body."

The White reference fails to disclose or suggest the features of the present invention recited in claim 9.

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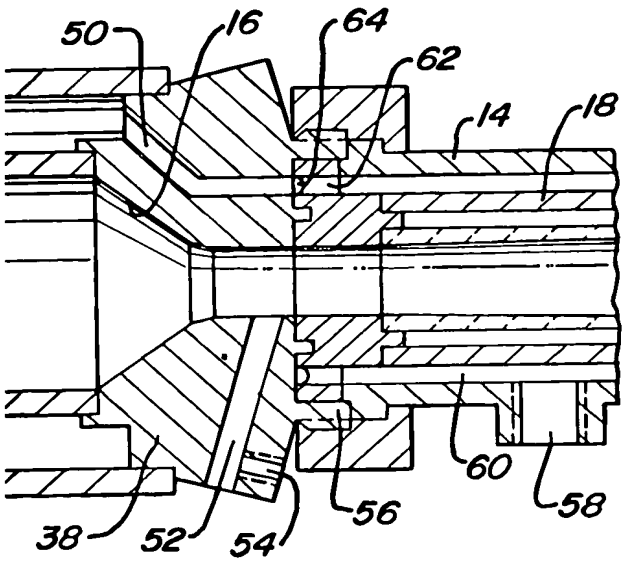
[1] *See, e.g.*, Specification ¶¶ [0008], [0011], [0013] (pressure at particle outlet several MPa lower than at upstream position, reducing particle pumping pressure needs; carrier gas permitted to be at a higher temperature upstream (and therefore more efficiently provided to the nozzle) because unlike upstream-injected particles, downstream-injected particles are not exposed to higher gas temperatures because the carrier gas is adiabatically cooled as the gas passes through the nozzle neck); *see also* ¶¶ [0004], [0012] (inclusion of a through-neck particle tube permits the outer portion of the nozzle to be manufactured with a substantially larger neck diameter (in order to provide the equivalent area about the particle tube as would have been present in an unobstructed Laval nozzle); this allows the nozzle components to be more conveniently and inexpensively manufactured, as high-precision machining of very fine neck diameters (~1.5 mm) is no longer required).

The pending Office Action, referring to elements numbers shown in White Fig. 1, states that White discloses a powder tube which "ends in the divergent section 19 of the Laval nozzle." January 9, 2006 Office Action at 2. It is further stated that it would have been obvious to provide the axial and centrically located nozzle shown in White Figs. 4b, 4c in the Browning (sic; White) outer nozzle. *Id.*

As a first matter, as shown in White Figs. 1, 2 (excerpt from Fig. 2 included for the Examiner's convenience, below), the White powder tube (not labeled in Fig. 1; element 52 in Fig. 2) ends *in the straight-sided neck portion* of the nozzle, defined by end adapter 38, not in the divergent portion 19 of the nozzle.



This is confirmed by the White specification, which states that the taper of insert 19 begins *after* the straight neck portion of venturi 16. White at 8:12-17 (referring to Fig. 3: "Insert 19 includes central bore 84, which extends from

entrance 86 to exit 88. Central bore 84 provides an interior surface having a taper ... running from entrance 86 to exit 88.").

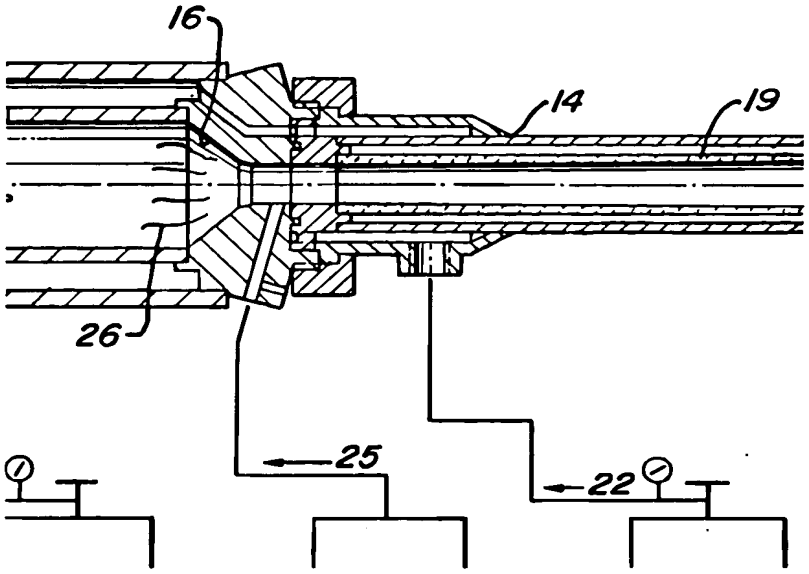
White therefore fails to disclose or suggest claim 9's powder tube which "ends in a divergent section of the Laval nozzle." Indeed, White teaches nothing more than the well-known prior art avoidance of Laval flow disruption by positioning an outlet in the wall of the nozzle neck, as in the Ek reference, and like Ek, fails to provide any suggestion of positioning the powder tube outlet downstream, in the divergent section of the nozzle.

Next, the schematic nozzle arrangements shown in White Figs. 4b, 4c also fail to disclose or suggest the present invention, let alone cure the deficiencies of White Figs. 1-3. As a threshold matter, White itself does not purport to teach anything regarding Laval nozzle flow in Figs. 4a-4d. Rather, as discussed at White 9:1-28, these figures *only* describe "a few of the various means for inserting coating material 25 into ... gas 26... ." Specifically. Fig. 4b only "depicts coating material M2 being inserted into converging flow streams ..." (particles shown in the figure injected *upstream* of non-Laval nozzle gas flow mixing point, and exiting into non-divergent wall section). Fig. 4c only "depicts coating material M3 being inserted into a radially injected flow stream ..." (particles injected into a straight-sized pipe (*i.e.*, non-Laval nozzle) from the side, like the prior art Ek reference). Figs. 4b, 4c therefore teach nothing which begins to suggest claim 9's powder tube ending in the divergent section of a Laval nozzle.

Finally, and perhaps most basic of the Applicants' grounds for traverse, White fails to show the recited Laval nozzle.

Claim 9 recites, *inter alia*, a cold gas spraying system "having a Laval nozzle comprising an outer nozzle body and a powder tube capable of feeding spraying particles into the outer nozzle body," wherein the Laval Nozzle "*is formed by an inner shape of the outer nozzle body together with an outer shape of the powder tube.*"

As shown in Fig. 1, below, the White apparatus does not disclose a Laval nozzle with an outer tube inner surface and a powder tube outer surface defining the nozzle.



The White powder inlet (labeled 52 in Fig. 2) simply has no outer surface in the flow stream which is shaped as part of a Laval nozzle surface, *i.e.*, there is no "powder tube" which "ends in a divergent section of the Laval nozzle and is aligned axially and centrically with the outer nozzle body" (and Figs. 4b, 4c are of no avail in this regard, as there is nothing in these figures which suggests their upstream axial powder tubes be moved downstream and given a Laval nozzle shape to preserve Laval nozzle flow characteristics, as in the present invention).

Because White fails to disclose or suggest, at a minimum, the present invention's location of an axial, centric powder tube outlet in the divergent region of a Laval nozzle, as well as failing to disclose or suggest a Laval nozzle with a powder tube so disposed and with inner and outer wall surfaces shaped to maintain Laval nozzle flow despite the presence of the powder tube in the neck of the nozzle, White fails to teach or suggest all of the features of the present invention recited in independent claim 9 and its dependent claims 11-17. Claims 9-17 therefore are patentable over this reference under § 103(a).

Reconsideration and withdrawal of the pending § 103(a) rejection is respectfully requested.

CONCLUSION

In view of the foregoing remarks, the Applicants respectfully submit that claims 9 and 11-17 are in allowable form. Early and favorable consideration and issuance of a Notice of Allowance for these claims is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038724.52882US).

Respectfully submitted,

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Robert L. Graberak, Jr.
Registration No. 40,625
Mark H. Neblett
Registration No. 42,028

CROWELL & MORING, LLP
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844